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Advanced UHV Thin-Film Deposition Facility for Research in Superconductivity and Superconducting Electronics

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6. AUTHOR(S)
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13. ABSTRACT *(Maximum 200 words)*

The final report for the above grant describes an "Advanced UHV Thin-Film Deposition Facility for Research in Superconductivity and Superconducting Electronics." A list of acquired equipment and a discussion of special circumstances regarding changes from the proposal and use of the equipment also follows. The completed facility is in full use for research as described in the proposal, and in high Tc superconducting materials research, other oxide materials, and C_{60} Fullerene alloys. A new vapor synthesis process monitor and control techniques (Atomic Absorption Rate Control) has been developed.

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Final Report ONR Grant N00014-84-J-1170 (formerly N00014-84-G-0170)
Title: Superconductivity and Superconducting Electronics Research
Principal Investigator: Professor M. R. Beasley

The following is a final report for the above grant. It includes a list of acquired equipment (by name, manufacturer, and cost), and discusses special circumstances regarding changes from the proposal, and the use of the equipment both as it relates to the work described in the proposal, and as it relates to other research of interest to the Department of Defense.

The name of the equipment in the proposal was "Advanced UHV Thin-Film Deposition Facility for Research in Superconductivity and Superconducting Electronics." During the design-stage for this equipment several circumstances resulted in delays and changes in the design. The original proposal was based on the major vendor being Thermionics Laboratory, Inc. However, when the time came to start work the two key people that would have been the major contributors were not available (due to one leaving the company, and the other to a serious illness and operation). After a new search for a single vendor to carry out the design and construction failed to locate one, the detailed design was initiated by a member of our research group with help from outside draftsmen.

The second circumstance also delayed, and altered the design and final use of the facility. This was the discovery of the High Temperature Superconductors, the copper oxide based materials. This introduced drastic changes in how the equipment was designed and fabricated, and, finally in its use. The immediate impact was on the time of the designer of the facility. The frenzied activity during the year 1987 through the present, but mostly the first three years resulted in delays in the design and implementation of the facility. The need to shift some of the design load onto outside vendors resulted in a shift in the proposed spending. The needs of the new materials necessitated some important changes, and, indeed inventions. Development of evaporation rate monitoring techniques that can function in the presence of a high background pressure of oxygen, and the development and understanding of methods to provide activated oxygen to the growth region of the thin films were two of the changes. These also result in necessitated changes in the spending from that in the proposal.

The completed facility is in full use for research as described in the proposal, and, of course, in high Tc superconducting materials research. With respect to other changes from the proposal as it relates to other research of interest to the Department of Defense, in addition to the area of High Tc Superconductivity, we are researching the synthesis of other materials including other oxide materials, and C_{60} Fullerene alloys. We also note that in the process of this work we have developed a new vapor synthesis process monitor and control techniques (Atomic Absorption Rate Control), and the genertion and monitoring of activated oxygen, and further similar activities are in progress. We expect these activities will find use to other Department of Defense programs.

The equipment is listed in the following. The majority of the construction was by R. J. Munns Mfg., Inc., who also assembled much of the system.

EQUIPMENT LIST FOR N00014-84-J-1170
(Formerly N00014-84-G-0170)

1. VAPOR DEPOSITION SYSTEM

R J MUMNS MFG	DEPOSITION SOURCE ASSEMBLY	$ 75,542
R J MUMNS MFG	RJ MUMNS ENG & DESIGN SERVICES/MBS	14,180
ELECTRONIC TRANSFORM	PROTOTYPE ETS X-Y SWEEP GENERATOR	5,377
NICK HUMENY CO	TEMP CONTROL/MSIC 1771 28840	1,797
PROTEUS INDUSTRIES	FLOW SWITCHES	1,597
STE INC.	ELECTRON BEAM SOURCE	3,825
	VALVES/NUTS/BELLOWS/TUBING/ETC	3,680
		105,998

2. LOAD-LOCK PROCESSING CHAMBER

R J MUMNS MFG	SUBSTRATE ARM SUPPORT/QUARTS MONITOR	24,636
R J MUMNS MFG	GLOVE BOX AND CART	30,005
R J MUMNS MFG	ASSEMBLY OF TRANSFER-SUBSTRATE ARM INNER AND OUTER SEALS/DESIGNS FOR GIMBAL ASSEMBLIES	49,220
NELSON HOWER	LOAD LOCK PROCESS CHAMBER PHASE II	7,000
LEHIGH DESIGN	LOAD-LOCK PROC CHAMBER	1,502
GRANVILLE PHILLIPS	ASSORTED	1,986
R J MUMN MFG	SAPPHIRE WINDOW/NIPPLE/VALVE	6,003
BEARING ENGINEERING	BEARINGS	4,365
BARNARD AND ASSOC.	BENDIX FLEXURAL PIVOT PART	1,167
	SENSORS/BEARINGS/BEAMS SPLITTER/ETC	2,883
		128,767

3. UHV VACUUM SYSTEM

R J MUMNS MFG	UHV VACUUM SYSTEM	25,327
R J MUMNS MFG	UHV VACUUM SYSTEM AND CONTROLS	98,887
VARIAN VACUUM	CRYOPUMP	15,649
"	CRYOPUMP	11,182
R J MUMNS MFG	ALCATEL PUMP	6,201
R J MUMNS MFG	VIEWPOINT WINDOWS, HEATER, ETC	4,349
VARIAN VACUUM	REMOTE TEMP DIGITAL DISPLAY	1,338
"	VALVES AND HOSE	1,631
LEHIGH DESIGN	UHV VACUUM SYSTEM DESIGN	1,028
VARIAN VACUUM	STARCELL VACION PUMP	7,155
"	POWER UNIT FOR ABOVE	1,312
"	HIGH VOLTAGE CABLE/ION PUMP METER	489
		174,548

4. DEPOSITION RATE MONITOR/FEEDBACK CONTROL

LEYBOLD	RATE MONITOR	5,912
BALZERS	PUMP/DRIVE UNIT/SPLITTER SCREEN	3,316
ALCATEL VACUUM	ALCATEL MECHANICAL VACUUM PUMP	1,164
VARIAN VACUUM	STARCELL VACION PUMP	4,794
"	NON-EVAPORABLE GETTER	2,140
"	POWER UNIT	1,584
"	HEATER/CABLES	1,091
	BEARINGS/RAILS/POSTS/LAMPS/ETC	1,460
		21,461

5. IN SITU CHARACTERIZATION EQUIPMENT

MICROSCIENCE	RHEED DIFFRACTION SYSTEM	25,101
VG INSTRUMENTS	SXP300 QUADRUPLE MASS SPECTROMETER	25,006
R J MUMNS MFG		5,350
		55,457

6. MILPISK	MILPISK PACKAGE: VACUUM CLEANER, EXHAUST FILTER, MICROFILTER, FLOOR BRUSH, 3" ROUND BRUSH, CREVICE NOZZLE	829

7. VWR SCIENTIFIC	DEIONIZED WATER SUPPLY SYSTEM	777
		487,837

8. MISC SHIPPING CHARGES, ETC	663
	$488,500
9. STANFORD UNIVERSITY COST SHARING	$ 60,000
TOTAL COST OF PROGRAM	$554,500